

## Description and Taxonomic Implications of an Unusual Arizona Population of *Apodemia mormo* (Riodinidae)

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**Abstract.** *Apodemia mormo* in the region of Nogales, Santa Cruz Co. Arizona, display variability unusual even in the *A. mormo* complex. At least five overlapping phenotype classes, some represented elsewhere by relatively uniform populations, are present in the area. The relationship of these specimens to adjacent *mormo* is unclear. It is possible that a "population" such as this may represent two or more entities isolated by such factors as voltinism and foodplant choice; larger samples and breeding experiments will be required to investigate this.

Southwestern populations of *Apodemia mormo* (Felder & Felder) display a complex variation pattern rivalled by few Nearctic butterflies. The only comprehensive treatment of the species to date is that of Opler & Powell (1961), and nearly 20 years later adequate population samples are lacking from many areas, especially northwestern Mexico. Samples at hand provide a somewhat confusing and contradictory picture. In some areas, there is evidence of latitudinal or altitudinal clines in the orange to black wing patterns, yet the reverse seems to occur elsewhere. Other difficulties include ill-defined intergradation zones, polytypy involving widely separated phenotypes, and voltinism differences between nearby domes. Powell (*in litt*) suggests the possibility of temporally isolated sibling species in some areas, and Emmel & Emmel (1973) feel some California populations may represent sympatric entities kept distinct by use of different *Eriogonum* larval foodplants. Langston (1974), in discussing voltinism in California *mormo*, questions the conspecificity of *A. m. mormo* and *A. m. virgulti*. With the occurrence of such distinct and restricted races as *A. m. langei* Comstock and *A. m. duryi* (Edw.), our understanding of this group is obviously far from complete.

In microcosm, the complexities involved with *A. mormo* are displayed by samples from Santa Cruz Co., Arizona, in the vicinity of Pena Blanca Lake and the Atascosa Mountains, northwest of Nogales (see Fig. 1). Here, the habitat consists of rolling oak-grass savanna, as characterized by Lowe (1964), at ca. 4200' (1280 m) elevation. *A. mormo* is widespread but uncommon, and is often captured singly at blooms of *Baccharis glutinosa*



Fig. 1. Southern Arizona locales for *Apodemia mormo* discussed in text. A: Atascosa Mts., B: Baboquivari Mts., H: Huachuca Mts., KP: Kitt Peak, Quinlan Mts., SC: Santa Catalina Mts., SR: Santa Rita Mts. 1: Pena Blanca Lake, 2: Box Canyon, Santa Rita Mts., 3: Sonoita Creek. Approximate scale: 1 inch = 25 miles (1 cm = 18 km). Inset: region of Arizona covered by Fig. 1.

Pers., *Aloysia*, and other flowers. *Eriogonum wrightii* Torr., a common southeastern Arizona foodplant for *mormo*, is not abundant in the area; no specimens known to the author were found directly associated with it. Three specimens were collected by the author at flowers of another *Eriogonum* (possibly *E. abertianum* Torr.). The populations appear to be at least trivoltine (III-V, VII-VIII, IX-X), in contrast to bivoltine (IV-V, VIII-IX) sequences at the north bases of Kitt Peak and the Santa Rita Mts., and the east side of the Huachuca Mts.

Arizona *mormo* populations lacking DHW orange are currently referred to *m. mormo*. Those with orange scaling on the DHW (and often VHW) are referred to *m. mejicana* Auct. (Behr?). As observed by Opler & Powell (1961), neither of these "subspecies" is itself homogenous; *mejicana* is highly variable within populations as well.

Examination of 20 *mormo* (12 ♂♂, 8 ♀♀) from the Pena Blanca Lake area revealed the following (see appendix):

1. The sample is extremely heterogenous, even for *mormo* (Fig. 2). At least five overlapping phenotype classes are present: two specimens

resemble the subspecies *maxima* (Weeks) both in size (the ♀ to 20 mm FW length) and color pattern; five large females (to 21 mm FWL) are of a dark *mejicana* phenotype, with variable DHW orange; two specimens fit the popular concept of *mejicana* (i.e. Huachuca Mts.); a fourth category is characterized by greatly reduced orange dorsally and increased white scaling along the subterminal DHW band. An Oslar record of *m. mormo* from Nogales is cited by Opler & Powell (1961); such a phenotype would result from further reduction of orange in these specimens. The fifth class forms a variable intermediate group having considerable DFW orange and extensive white scaling along the subterminal band. One male of this group was found associated with the "large" *mejicana* females (group two). The extreme variation prevented exact assignment of each individual to one group or another.

2. It is noteworthy that none of the above categories is *restricted* to the Nogales region, but each occurs in varying frequencies elsewhere, sometimes as a relatively uniform population. For example, the large *mejicana* specimens (Fig. 2, row 3, *a*) are quite similar to scattered individuals from the Baboquivari Mts., Sonoita Creek, and the Box Canyon area of the Santa Rita Mts. (see Fig. 1). They also show affinities with specimens from far to the east (Davis Mts., Texas). The Sonoita Creek and Baboquivari Mts. populations given evidence of trivoltinism as well. Powell (*in litt*) notes the similarity between August specimen from the Chiricahua Mts. (near Portal) and the fourth phenotype discussed above. Specimens from near Douglas (Perilla Mts.) are also of this type.

The trivoltine "large" *mejicana* phenotype is not present in large samples from low elevation orange VHW populations at Kitt Peak, the Santa Rita Mts., and the Huachuca Mts. The darker phenotypes in the Nogales sample are equally separable from dark higher altitude specimens from Kitt Peak and the Santa Ritas (Fig. 2, row 3, *b* and *c*), especially with respect to the white scaling along the subterminal DHW orange band (as in *m. mormo*, Fig. 2, row 4, *b*).

The similarity of occasional individuals from Nogales and the Santa Catalina Mts. to *maxima* is intriguing. Although no uniform populations of this phenotype are known from north of central Baja California, it may apparently be produced in both juniper-oak and low desert habitats.

Superficial observations on "similarities" are not meant to neglect genetic implications. As indicated by Mayr (1963), very similar phenotypes may be produced by different gene assortments in sympatric populations. Mayr also observes that color patterns may not be correlated with maximum adaptability, but may be the result of pleiotropic effects of genes controlling phenotype survival. In this regard, care must be taken in assessing the relationship of the Pena Blanca *mormo* with nearby populations.



Fig. 2. *Apodemia mormo* (dorsal) from Arizona and Baja California.

Row 1. *A. m. maxima* ♀, Loreto, Baja Calif. Sur, 1 Dec. 1977, GSF. "Maxima" phenotype ♀, Molino Canyon, 4200', Santa Catalina Mts., Pima Co., Ariz., 23 Oct. 1960, Wm. Hedges. "Maxima" phenotype ♀, Summit Motorway, Atascosa Mts., Santa Cruz Co., Ariz., 24 Feb. 1978, R. Bailowitz.

Row 2. "Mejicana" phenotypes: Box Canyon, 4700', Santa Rita Mts., Pima Co., Ariz., 11 Aug. 1978, GSF (♀). Ruby Road, Atascosa Mts., Santa Cruz Co., Ariz., 9 Aug. 1977, J. W. Brown (♀). Elkhorn Ranch, Baboquivari Mts., Pima Co., Ariz., 20 Mar. 1978, GSF (♀).

Row 3. Dark "mejicana" phenotypes: Summit Motorway, 4500', Atascosa Mts., Santa Cruz Co., Ariz., 4 Aug. 1978, GSF (♀). Tres Amigas Cyn., Atascosa Mts., Santa Cruz Co., Ariz., 18 Mar. 1978, R. Bailowitz (♂). Kitt Pk. Road, 4200', Quinlan Mts., Pima Co., Ariz., 11 Sept. 1974, GSF (♀).

Row 4. Light "mejicana" phenotype, 2 mi. W. of Pena Blanca Lake, Santa Cruz Co., Ariz., 31 July 1979, RAB (♀). "Mormo mormo" phenotype, N. Base Kitt Peak, 3800', Quinlan Mts., Pima Co., Ariz., 29 April 1977, GSF (♂). Light "mejicana" phenotype, N. Base Kitt Pk., 3800', Quinlan Mts., Pima Co. Ariz., 1 Oct. 1974, GSF (♂).

A "blend zone" concept, as postulated by Opler & Powell (1961) for (primarily) California intergrade zones, does not seem to account for all variation observed in southern Arizona:

1. There is little evidence that gene flow (at present) is appreciable in this area, where *mormo* populations are often discrete and restricted to montane and foothill associations. As the species tends not to occur in the

creosote bush-mesquite scrub between mountain ranges, it is difficult to document interbreeding of races. However, Bowden (1979) observes the importance of historical ecological factors in influencing wing pattern phenotypes observed today; conceivably populations that are presently sympatric were not even discrete during more favorable climatic periods.

2. Variation in *mormo* involves an altitudinal component which must be carefully considered. How, if at all, does a montane population relate to those from 3000' below? Such altitudinal differences tend to produce allochronic populations even in the same mountain range.

3. With the isolated populations, the character and size of the blend zones are difficult to assess. Very similar variation patterns are present in the Baboquivari Mts. and Davis Mts., Texas, yet the latter are remote from any *m. mormo* influence. And although a striking intergrade zone exists at Kitt Peak, Tilden (*in litt*) records both *mormo* and *mejicana* at Sells, almost 20 miles (32 km) northwest. Is the blend zone width defined by these records, or are they samples from distinct populations?

4. Occasional phenotypes are found that normally occur in distant populations. Richard Bailowitz records a single specimen of the dark *mormo* phenotype from Onion Saddle at ca. 8000' (2440 m) in the Chiricahua Mts., well southeast of the normal range of *m. mormo*. A further example is the occasional presence of the *maxima* phenotype in southern Arizona.

5. In at least one case, contiguous races have not developed an appreciable intergrade zone. At the western edge of the Colorado Desert in California, *A. m. virgulti* (Behr) and *A. m. deserti* Barnes & McDunnough are evidently parapatric in the transition zone from foothills to desert. Evidence for intergradation is slight; approximately 50 m separate the races at Mountain Springs Grade in San Diego Co., yet in a sample of 40 specimens only three suggest intergradation, and these may represent variation in *virgulti*. Opler & Powell (1961) cite intermediate phenotypes from Riverside Co., but these lack precise locale data. This California zone admittedly differs from the Kitt Peak intergrade zone (a steeper topographical gradient and restriction of each form to a different *Eriogonum*) but the orange-banded vs gray-white phenotypes involved are similar in the DHW color patterns.

It is evident that the 9-11 accepted subspecies of *mormo* are of limited value in handling variation of this magnitude. Nevertheless, it is instructive to note the occurrence of a named race in widely separated areas. A striking example is the presence of *A. m. dialeuca* Opler & Powell in the mountains of both California and Baja California Norte (Stanford, 1973). Such polytopic races, the often abrupt phenotypic changes with altitude, and discrete populations, suggest multiple factors control the phenotypic plasticity observed in Arizona.

In the region between Sells and the Santa Rita Mts. (including Nogales), it seems probable that transitional and localized selective pressures have not effectively channeled the color patterns in a single direction. Polymorphic intergrade populations would then result from intermediacy in the selection factors which elsewhere produce more uniform phenotypes. The resulting demes would be further subject to altitudinal modification; phenotypic reversion to "mormo" well within a zone occupied by "mejicana" would then be explicable. In the broad transition from *mormo* in the low western deserts to *mejicana* in the southeastern desert grassland, intermediacy in environmental factors often parallels intermediacy in phenotypes; the Nogales populations show evidence of altitudinal effects as well.

The *mormo* complex shows a phenotype composition resulting from the interaction of poorly understood climatic, topographic, and biotic selection factors. The heterogenous population described here shows that a relatively uniform phenotype in one area (such as *maxima*) is in another only one component of a highly polymorphic assemblage. Understanding of variation in the Nogales region, based on further collecting and breeding experiments, would certainly help determine relationships in this difficult group.

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## Appendix

### Data from Specimens Examined, Grouped by Phenotype Classes

Conclusions on seasonal and sexual variation in the Nogales area are limited by the small sample size, dates of capture in seven months, and samples from scattered locales. Collectors: Richard A. Bailowitz (RAB), John W. Brown (JWB), and Gregory S. Forbes (GSF).

#### ARIZONA: Santa Cruz Co.:

Group 1.: *maxima* phenotype. Ruby Rd., ca. 5 mi W Pena Blanca L., 4400', 9-VII-1977 (JWB), 1 ♂. Summit Motorway, Ruby Rd., 4 mi W Pena Blanca L., 4300', 24-III-1978 (RAB), 1 ♂.

Group 2.: "dark" *mejicana* phenotype. Ruby Rd., 3.5 mi W Pena Blanca L., 4200', 12-VIII-1975 (GSF), 1 ♀. Ruby Rd., 0.7 mi W Summit Motorway, 4400', 4-VIII-1978 (GSF), 2 ♀♀. Ruby Rd., ca. 5 mi W Pena Blanca L., 4400', 9-VIII-1977 (JWB), 2 ♀♀.

Group 3.: "light" *mejicana* phenotype. Ruby Rd., 2 mi W Pena Blanca L., 400', 31-VII-1979 (RAB), 1 ♀. Ephraim Cyn., 1 mi W Nogales, 3900', 20-IX-1978 (RAB), 1 ♂.

Group 4.: reduced orange with white subterminal band scaling. NW side, Pena Blanca L., 3900', 23-III-1978 (RAB), 1 ♀. Tres Amigas Cyn., Atascosa Mts., 18-III-1978 (RAB), 1 ♂. Summit Motorway, Ruby Rd., 26-III-1978 (GSF), 1 ♂. Alamo Cyn., Atascosa Mts., 30-III-1978 (RAB), 1 ♂.

Group 5.: "intermediate" *mejicana* with white subterminal band scaling (not illustrated). 4 mi W Pena Blanca L., 7-VIII-1979 (GSF), 1 ♂, 11-VIII-1978 (RAB), 1 ♂. Ruby Rd., 0.7 mi W Summit Motorway, 4-VIII-1978 (GSF), 1 ♂. Ruby Rd., ca. 5 mi W Pena Blanca L., 9-VIII-1977 (JWB), 1 ♂. Potrero Cyn., 7 mi W Nogales, 23-X-1977 (RAB), 1 ♂. Tres Amigas Cyn., 3 mi S Ruby, 13-V-1979 (RAB), 1 ♂. 0.8 mi W Pena Blanca L., 4000', 21-VIII-1975 (GSF), 1 ♂.

